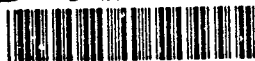
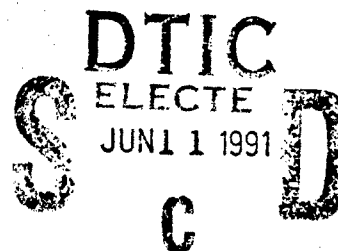


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CHEMICAL WARFARE: IMPLICATIONS FOR OPERATION DESERT STORM AND
BEYOND

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations.

The contents of this paper reflect our own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

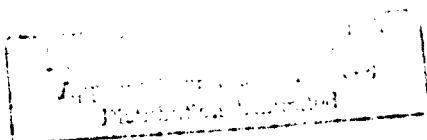
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CHEMICAL WARFARE: IMPLICATIONS FOR OPERATION DESERT STORM

CHAPTER 1

INTRODUCTION

By definition, chemical warfare encompasses all aspects of the military use of defensive countermeasures as well as offensive employment of lethal and incapacitating agents.¹ Interpretation of when its use is acceptable varies among many democratic, communist, and other forms of government.

Serious discussions on the morality and acceptability of its use have been on-going since circa 1890.² Not until 1975 did the U.S. confirm its official position regarding the legality of employment of chemicals in war.³ Although the use of riot control and herbicidal agents has been associated with chemical warfare, this paper is limited to the modern use of lethal chemical agents and the associated legal, political, and operational considerations as they may apply to the United States in the Persian Gulf War and beyond.

CHAPTER II

HISTORY

Documented use of chemicals in warfare dates back to 431 B.C. with the employment of sulphur fumes by the Spartans. However, not until this century has adequate laboratory research and industrial processing been able to produce sufficient quantities of lethal chemicals such that chemical warfare could be operationally decisive.

Trench warfare, with all its grotesqueness, was an ideal testing ground for chemical warfare tactics. The Germans would develop new agents; the allies would correspondingly develop countermeasures: the upward spiral continued.

In 1915, 3,870 tons of gas were used; five, ten and fifteen times as much were employed in the next three years respectively⁴ amounting to an estimated 5,000 allied fatalities, 10,000 allied injured,⁵ 56,000 Russian fatalities, and 475,000 Russian injured.⁶ The greater disparity on the eastern front was due to the poor readiness of the Russian troops in addition to inadequate or no protective equipment. Over the course of WWI, chemical warfare, ".....accounted for approximately 1,300,000 casualties (dead or wounded)."⁷

Despite the high casualties caused by chemical warfare in WWI, its use was not strategically significant in the outcome of the war. Effective employment of chemical munitions by field commanders on both sides was significantly hampered by poor discipline by offensive troops, transportation and handling problems, and the inherent danger of using phosgene or phosgene/chlorine mixed unitary munitions.

Post WWI gas studies concluded that gas did achieve some local success through tactical surprise if quickly followed by concentration of forces. However, the future utility of poison gas use on the battlefield truly began to be studied by tacticians and became a subject of

fierce legal and ethical debate which still exists today.

Non-enforcement of the German rearmament requirements contained in the Treaty of Versailles, along with a long term commitment by Russia to never suffer gas casualties as was experienced in WWI, set the stage for significant Russo-German collaboration on gas research, testing of delivery devices, and tactics. By 1938, Germany had secretly discovered two nerve gases, tabun and sarin. At the same time, Italians under Mussolini had built up large stocks of mustard gas, developed the military education training and field units and the weaponry required to use gas in war, and were testing their weapons in the Italo-Ethiopian War of 1935/6. Additionally, despite diplomatic efforts to define international standards for the conduct of war pertaining to the use of lethal agents, the Japanese were gassing Chinese in 1937/8⁸ while Britain was investing considerable resources in protecting its civilian population from the threat of chemical warfare.⁹ Both the Italian and Japanese use of poison gas were conditioned on their enemy's inability to retaliate.

Even though the 1925 Protocol made the use of chemicals in war illegal, the United States, Britain, Russia, Italy, Germany, and Japan continued to build extensive military and industrial chemical capabilities. The development of chemical agents and their delivery vehicles were shrouded in secrecy so nations assumed that their own stockpiles and chemical readiness were inadequate relative to the enemy. Despite the capability for chemical warfare by most belligerents, they were not used during WWII even though there were numerous opportunities for strategic employment. The only plausible explanation for such a standoff is deterrence through fear of retaliation. Each nation was concerned with the escalatory potential of chemical retaliation even though enormous capital had been invested in chemical employment by every conceivable means. To some degree, the same situation continues today

except we have a more devastating ability to retaliate: nuclear warfare.¹⁰

One of the better documented case histories of the successful and decisive use of chemical warfare is the Italo-Abyssinian War that commenced in 1935. Mussolini's gas tactics were used for three main purposes:

1. Mountain forces defensively employed chemicals on their flanks which filled a critical weakness of the Italian's ill-suited infantry tactics in that terrain.
2. Gas interdiction of enemy supply convoys instilled terror among those in rear camps and destroyed livestock.
3. Mixed with conventional high explosives attacks, gas was used behind enemy front-line troops. Heavy artillery and machine guns would then be used to drive the enemy back through the gas.¹¹

After-action documentaries seem to capture the essence of why lethal chemical agents have been used often in third world conflicts since WWI and they also help to understand why the question of ethics has diplomats embroiled in the deterrence, retaliation, and no-first use debate.

Well-documented and verified accounts of chemical warfare include Italy's 1935-1937 use in Ethiopia,¹² Japan's 1937-1945 use in Manchuria,¹³ Egypt's 1960's use against Yemen,¹⁴ Vietnam's 1975-1981 use in Laos and 1978-1981 use in Kampuchea, Soviet 1979-1981 use in Afghanistan,¹⁵ and Iraq's 1983-1988 use against Iranians and Kurds.¹⁶

In 1980, while Saddam Hussein was developing his lethal chemical warfare capability, Iraqi troops crossed into Iran and commenced what turned into an eight year war. The first documented use of chemicals in that war was in 1982, when the Iraqis used tear gas against advancing Iranian forces. This use of riot control agents caused thousands to panic on the battlefield.

By 1984, the Iraqis employed nerve gas on Iranian defensive strongholds causing over 1,700 casualties (killed or wounded).¹⁷ This use was primarily focussed in combat over the Majnoon Islands when Iraqi conventional firepower failed to route the enemy. The Iraqis also found that they could use mustard gas to contaminate enemy areas for days and that by hitting rear areas - troop and supply concentrations - they could avoid inadvertent self-contamination.

By 1985, Iraq was using aerators and artillery to deliver chemical weapons; by 1986 however, significant international pressure caused Iraq to limit the use of chemical weapons to last ditch defensive tactics.¹⁸ The apparent restraint by the Iraqis was possibly due to three factors: initial use was only to send a signal to the Iranians that if they continued the offensive, larger scale use was possible; Iraqi technological limitations with delivery platforms and his military's preference for conventional weapons; and/or Iraqi sensitivity to American and European opinion.¹⁹

Iraq used concentrated and coordinated chemical assaults only when she was about to be overrun by the Iranians. Hussein is thus very likely to in Kuwait with every available weapon that he has.²⁰

CHAPTER III

LAW

The basis for international law governing chemical warfare is the 1925 Geneva Gas Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare. Parties to this agreement include all NATO and Warsaw Pact countries; however, adherence to the agreement was conditioned "on the understanding that the prohibition against use of chemical weapons ceases to be binding with respect to nations whose armed forces, or the armed forces of their allies, fail to respect that prohibition." The United States has interpreted the Protocol as restricting the *initial* use of chemical munitions.²¹ "The 1925 Gas Protocol does not prohibit the development, production, testing, or stockpiling of chemical weapons, nor does it prevent equipping and training military forces for chemical warfare."²²

CHAPTER IV

POLICY

Chemical weapons, under United States policy, are separated into three categories: "lethal and incapacitating agents, riot control agents, and herbicidal agents."²³ The subject of this paper focuses on lethal and incapacitating agents and how they might play into the ensuing Gulf War.

Within the legal interpretation of chemical warfare are several terms with expanded definitions. Those definitions used in official U.S. policy statements, with regard to chemical warfare, are buried in 50 U.S.C. and for the sake of brevity, some of the more relevant terms including chemical operations and chemical munitions are defined.

Chemical operations is the use of agents to kill, injure, or incapacitate man for long periods, and involves denial of terrain, facilities, or material.²⁴ The agents are placed into chemical munitions which are either binary or unitary. Binary munitions involve physically separated benign chemicals that mix while en route to the target to produce the lethal agent. They are safer to handle and store, but are complicated in design and manufacture. "Unitary munitions are filled with the pre-mixed complete agent...simple in design...which opens or bursts on or over the target releasing the agent."²⁵

Also included in the policy statements are descriptions of nerve agents, blood agents, choking agents, and blister agents. "Nerve agents are lethal...similar to commonly used insecticides...several orders of magnitude more toxic...vaporize into the air" and act on human tissue through inhalation, ingestion, or absorption; typically, death by suffocation occurs. Blood agents are cyanide group chemicals which are highly volatile, spread rapidly in air and stop the transfer of oxygen to the blood causing rapid death.²⁶ Choking agents, such as

phosgene, attack the lungs, causing them to fill up with fluid; victims essentially drown. Blister agents, such as mustard, cause death if inhaled but more commonly incapacitate victims with painful skin burning and severe blistering.²⁷

The President is required to certify that chemical munitions production is needed to protect the national interest and he must certify to Congress that unitary munitions are destroyed.²⁸ The certification for unitary munitions destruction is required due to the inherent risk involved with their storing and handling and the chemical munitions production certification ensures that chemical weapons fill a valid need in US military strategy: most probably to form a link between high intensity conventional conflict and limited nuclear war.

Interpretation of the many laws, treaties and agreements, since the 1925 Protocol, surrounding the use of lethal and incapacitating agents is fundamentally common. Many countries interpret the Protocol as a right to retaliate; however, some subtle differences exist between Protocol signatories as to when, under what conditions, and to what extent retaliation is authorized. Rationale presented for the current U.S. position regarding acceptability of chemical munitions employment is lengthy; the official position of the United States is stated briefly below.

The United States considers the prohibition against first use of lethal and incapacitating chemical weapons to be part of customary international law and, therefore, binding on all nations whether or not they are parties to the 1925 Gas Protocol. Lethal chemical agents are those asphyxiating, poisonous, or other gases; analogous liquids; or materials that cause immediate death. Incapacitating agents are those producing symptoms that persist for appreciable periods of time after exposure to the agents has terminated. Because the 1925 Gas Protocol effectively prohibits only first use of such weapons, the United States maintains a lethal and incapacitating chemical weapons capability for deterrence and possible retaliatory purposes only. National Command Authorities (NCA) approval is required for

retaliatory use of lethal or incapacitating chemical weapons by U.S. Forces. Retaliatory use of lethal or incapacitating chemical agents must be terminated as soon as the enemy use of such agents that prompted the retaliation has ceased and any tactical advantage gained by the enemy through unlawful first use has been redressed.²⁹

The following words spoken by President F. D. Roosevelt on 8 June 1943 describe one American view toward chemical warfare:

The use of such weapons has been outlawed by the general opinion of civilized mankind. This country has not used them, and I hope we will never be compelled to use them. I state categorically that we will under no circumstances resort to the use of such weapons unless they are first used by our enemies.³⁰

President Richard M. Nixon, in 1969, renounced the first use of chemical weapons and stated that the United States would retain a chemical retaliation capability until a verification plan for the removal of all chemical agent could be achieved.³¹ He further stopped U.S. lethal chemical weapons production in the same year; however, the DOD disagreed and believes even now "...that only an improved chemical capability will deter the Soviets from using chemicals in a future war."³² In 1970, Nixon sought U.S. ratification of the 1925 Protocol and in January 1975, under President Ford, the United States confirmed support for the 1925 Geneva Protocol.³³

The U.S. position of no first use is in keeping with traditional American moral and ethical attitudes on humane death. A bullet through the chest is painful and ugly but generally provides for a quick death. However, most chemical warfare victims die tortuously, with severe burns, suffocation or by a dysfunctional central nervous system. A concept of fair play laced with the desire to confront the enemy in the traditional sense of face-to-face combat seem to explain the distaste for the use of chemicals in war. In reality, chemical weapons could be

used very effectively in some combat operations and could certainly raise the nuclear threshold.

Since the 1969 ban on chemical warfare production, the United States has focused on the "...development of protective clothing and equipment, technologies to identify and detect chemical weapons that hostile forces might employ, decontamination methods and medical treatments."³⁴

To discuss the Iraqi threat later in this paper, knowledge of Soviet capability and intent is helpful because the Iraqi military is a mirror image of the Soviet's and thousands of Soviet military advisors remain in Iraq, even after the commencement of hostilities by the Allies in the current Gulf War. Despite Mr. Gorbachev's new ideas and openness policies, it appears the same Russian military strategy may lurk underneath - a changing policy with a constant strategy.

Typical of the two-level nature of Soviet foreign policy, Soviet diplomats persistently denounce the use of chemical weapons³⁵ insisting to the United Nations that they embrace a no first-use policy while they refine an existing, well prepared and overwhelming chemical warfare capability. Soviets play heavily in third world chemical warfare actions and have provided chemical warfare support to their communist allies.³⁶ The U.S.S.R. has an enormous chemical industry consisting of nine major chemical warfare storage depots, six of which are in the western half of the country; they also have ten lethal agent production centers, all of which are located several hundred miles inland, stretching from the border of Iran northwestward to Poland. With chemical proving grounds incorporating active test grids³⁷ and extensive equipment inventories, including decontamination and overpressure systems designed into most of their force, Soviet chemical warfare intentions and potential for use become more revealing.

CHAPTER V

STRATEGY

Between Iraq's national goals and their military doctrine lies their need to reverse the Allied initiative in the current war and their plan to attain their objectives: to protract the conflict, cause the Alliance to fail and ultimately, to retain Kuwait. The link between Iraq and the Soviet Union is well-known, particularly the military association.³⁸ Understanding the Soviet part in Iraqi chemical warfare readiness is fundamental to analyzing the effectiveness of Iraqi strategy.

Soviet military doctrine is well-balanced, incorporating conventional, chemical, and nuclear weapons.³⁹ "Soviet military literature has consistently stressed the importance of surprise, speed of advance and sufficient fire-power brought to bear at strategic locations as cardinal elements of its military strategy. This blitzkrieg strategy is designed to compensate for the Soviet Union's inferior resource base..."⁴⁰ and is highly dependent upon quick, decisive victory at the tactical level. This operational doctrine working in consonance with deception, deceit and secrecy at the political level provides some basis for projecting how Iraqi strategy may work.

Iraq's army, under significant advice from the Soviets,⁴¹ has recently been battle-hardened in conflict with Iran, performed field experiments in lethal agent use against Kurds and Iranians and absorbed most of its nation's wealth in military hardware. How these experiences and the military buildup support Saddam Hussein's strategy and how chemical warfare fits into his grand scheme after Iraqi sustainment capabilities have been severed, are worth investigating. Through analysis of Mr. Hussein's experience, his close association with the Soviet Union through military equipment acquisition, troop training, and political oversight

(Bolshevik regime), one may conclude how Iraq might operationally employ chemical weapons.

Two important factors may discourage Iraqi employment of chemical weapons: diplomatic concurrence against its use and international law forbidding it. That Iraq is a 1931 signatory to the Geneva Protocol,⁴² may not be so important to Saddam Hussein as the potential for operational gain that might lead to war protraction: a strategy that the United States and her allies have been aware of and preparing for by removal of Iraqi command and control (C²) and logistical capability prior to commencement of the ground campaign.

From historical accounts, most of the use of chemical warfare was by a superior force and was employed to complement conventional firepower or make up for a particular weakness due to terrain unfamiliarity or difficulty (such as jungle canopies in southeast asia). This fact, although true, cannot be used to dismiss the possibility or lessen the potential impact of an all-out chemical attack by Iraqi forces. We are nearing a situation where Mr. Hussein may be in death ground⁴³ and if he is not left a way out, either tactically or strategically, not only could allied forces have a nasty entrenched chemical war standoff but also a greater foe as a result. The purpose of this paper lies not in whether Saddam Hussein has or will authorize the use of lethal agents on the battlefield, but how their use might be tactically employed and what their use may mean in the strategic and operational sense.

The United States has a policy-strategy match; however, the chemical warfare readiness of American troops, the U.S. position with regard to funding agent research, and the state of U.S. protective equipment indicate that operational capability to support a strategy of retaliation may not be up to the task, particularly if U.S. forces went against Soviet forces. Of course, we are against a less coordinated and less capable foe, but that in itself is not sufficient

to discount the Iraqi chemical threat.

Although the U.S. strategy of retaliation may be less than desired, America does have a chemical munitions stockpile, delivery vehicles and trained personnel. Given a large operational advantage to the enemy by the use of chemicals, the United States could be forced to raise the intensity threshold because the numbers of chemical units in the U.S. armed services is inadequate to play in a protracted AirLand battle.

Within NATO, for example, a much better prepared joint organization exists than is in the Gulf, and a general lack of standardization, training, troop outfitting, munitions modernization and defensive equipment has left a weak chemical warfare posture but more importantly, has undermined the credibility of U.S. strategy. How can the United States expect to deter a massive first strike employing highly toxic weapons in lethal concentrations by threatening retaliation without a credible and sufficient capability to retaliate in kind?⁴⁴

The Soviet Union has capitalized on this strategic dilemma and Iraq is probably aware of the U.S. inability to respond in kind to a large chemical attack. If Iraq's use of chemical weapons brings condemnation from the west and no nuclear weapons retaliation is executed, then a great strategic advantage over conventional forces may be attained. This situation makes fighting a nation with a huge chemical arsenal and large conventional forces very dangerous.

Scaling this example toward Iraq, we have reasoned that Mr. Hussein could employ chemicals without fear of nuclear retaliation. Moreover, with the lack of emphasis by U.S. forces on offensive tactics in chemical warfare, Allied forces may be far better off to steer away from the use of chemicals, as chemical operations are significantly more complicated and difficult to coordinate than straight conventional warfare. Even if the NCA decided to punish Iraq troops for her employment of chemicals, political constraints may supersede the military strategy required to gain operational advantages taken by Iraq.

CHAPTER VI

TACTICS

The purpose of this chapter is to outline logical courses of action by entrenched Iraqi forces currently in southern Iraq and Kuwait. Reference to chemical warfare physiology, historical principles, Soviet chemical warfare doctrine and assumptions precede the actual battlefield analysis.

Chemical weapons are essentially invisible and are grouped in the same category with nuclear and biological weapons as tools for mass destruction. Chemicals are generally difficult to get directly on target (unless by artillery) and if troops are caught unprepared, treatment is difficult if not impossible.⁴⁵

Due to the unpredictability of incapacitating agents the United States has primarily focussed on lethal agents: blister and nerve. Although choking agents such as chlorine and phosgene can be lethal, their smell warns of its presence and are thus ineffective against troops with minimum readiness.⁴⁶

Blister agents come in two types: arsenicals and mustards. The biggest problem with the arsenicals is that they have a distinctive odor and cause eye pain which warns personnel. Mustards are much more difficult to detect; symptoms occur 4-6 hours after exposure and the chemical in gaseous or liquid form "...can penetrate leather, clothing, plastic, and other materials, readily." As such, they are great terrain denial weapons. The United States still has large stockpiles of mustard.⁴⁷

Blood gases, hydrogen cyanide and cyanogen chloride cause death very quickly "once inhaled and absorbed in the bloodstream." The problem with its use is that it chokes and causes severe irritation to the eyes; this warns others that it is present.⁴⁸

Hardly perceptible by the troops, nerve gases are also more lethal than blister and blood agents. Tabun, one of the first nerve chemicals, is odorless, colorless, and can be inhaled or absorbed.⁴⁹ The Germans, during WWII, also developed sarin and soman. Both chemicals can kill within 15 minutes if inhaled or 1-2 hours if absorbed through the skin.⁵⁰ Sarin is also stockpiled by the United States. Sufficient evidence suggests that Iraq has tabun, sarin and mustard gas.⁵¹ The greatest difficulty is that we have limited human intelligence to verify and quantify munitions stockpiles and delivery capabilities. Table I lists the most probable chemicals in Iraq's inventory; note that very little VX is required when compared to the other nerve agents.

TABLE I

IRAQI CHEMICAL INVENTORY

<u>AGENT</u>	<u>TYPE</u>	<u>PERSISTENCY</u>	<u>LETHAL DOSE</u> (mg-min/m ²)
Phosgene	Lung irritant	minutes	
Hydrogen cyanide	Blood	minutes	
Cyanogen Chloride	Blood	minutes	
Mustard	Blister/Burn	2-7 days	
Tabun	Nerve	1-4 days	300
Sarin	Nerve	15min-4hrs	75
Soman	Nerve	2.5-5 days	35
VX	Nerve	3-21 days	5

The British developed the V-agents in the 1950's, of which the U.S. Army VX agent⁵² is stockpiled by the United States. VX is sprayed and has the consistency of motor oil. Depending upon the agent concentration, VX can continue to kill personnel for weeks if tactics call for territorial denial. The lethal concentration is around 15 mg per man. At about 100 mg per man, VX penetrates summer combat clothing and boots. If laid down at 300 kg per km², weeks of territorial denial can be attained.⁵³

Standard nerve gases are sarin and VX for the United States. The Soviets have developed a thickened and more persistent version of soman called VR-55 which is very similar to sarin.⁵⁴ It is likely that Iraq possesses an agent similar to VR-55.

Chemical munitions can be delivered by mines, mortars, artillery, rockets, missiles and aircraft.⁵⁵ By far, the most effective chemical delivery platform is the, "Soviet BM-21 multi-barrelled rocket launcher, which fires 40 rounds in 20 seconds at a maximum range of 20 km. One battalion fires 720 rounds in 30 seconds for lethal concentration over one km²."⁵⁶ For the purpose of this paper, we are assuming that Iraq has these platforms. Factors that may play into a force on force scenario follow:

1. Spreading 4000 kg of sarin over a 6 km line upwind of a well-prepared enemy, would attain approximately 25% fatalities and 75% light casualties. If defensive countermeasures were weak, up to 75% fatalities could be expected.⁵⁷
2. Environmental factors such as wind direction and velocity (time to reach the enemy) and ground and air temperatures (evaporation rate), play a significant role in chemical effectiveness.⁵⁸
3. Properly employed, chemical weapons can be effective as far as 100 km downwind. Ideal sarin attack conditions are 7 km per hour breeze, and a concentration of 500 kg/km for 14 hours.⁵⁹

4. Rain can break down and disperse the chemical compounds; the best time to lay the attack is at the end of a sunny day when a "...mass of cool air may be formed beneath a hot light air mass." The cool air mass close to ground would contain the lethal concentration throughout the night.⁶⁰

5. Open areas (desert sand) would tend to work against chemical effectiveness because of sand porosity. Thickened agents may work well in urban areas because Iraq and Kuwait building materials tend to absorb and retain the agent for long periods.

6. In the defensive mode, detection upwind is very important for warning. The only protection from the most lethal agents available today are totally impermeable suits (rubber-coated); however, these suits make offensive operations in warm climates, like Iraq, extremely difficult.⁶¹

7. Command posts and all potentially attacked structures, military vehicles and ships must maintain a filtered air supply to withstand a well prepared chemical attack.⁶² Decontamination requires extensive supplies of water and is extremely labor and equipment intensive.⁶³

8. Medically, a limited capability to prepare for a chemical attack is possible. In addition to medical injection prior to battle, self-administered antidote, if performed rapidly after exposure is effective for personnel that receive a dose up to low lethal concentrations. At high concentrations, the probability of escape is much less; mask filters must be changed and rips or holes in protective gear render them inadequate against agents that can be absorbed.⁶⁴

A synthesis of post WWI principles of chemical warfare, that may be applied to the current Gulf forces alignment, is contained in two general statements below:

1. Given that the enemy is in fortifications or trenches, gas can search out the enemy and cause him to move. If caught unprepared, gas can surprise him by an "...off-target attack, letting the agent drift downwind."
2. Mixed with artillery high explosives, gas can be built up in lethal concentration in 15-30 seconds; the number of casualties will depend on gas readiness training of personnel.⁶⁵

Soviet chemical warfare doctrine describes five distinct tactical situations where the employment of chemical munitions may be warranted. Since Iraqi field leaders have been trained in this doctrine, great potential exists for application to the current Gulf War. "Unique operational advantages [to achieve] surprise, speed, and shock..." may be attained by use of the following:

1. Concentrate chemical weapons on the forward edge of the battle area inflicting heavy casualties to be followed by a tactical breakthrough. BM-21 multiple rocket launchers would be used; each motorized rifle division (MRD) has eighteen 40-barrel launchers capable of 720 rounds per salvo. If an envelopment were desired, a "...fast-acting, undetectable, highly penetrating but non-persistent agent like hydrogen cyanide would dissipate in less than 10 minutes..." allowing quick overrun of the enemy area. No protective gear would need to be worn by the attacker. The attacked troops would still be fighting in suits and would be overwhelmed by casualties. The agents could be delivered with SCUD surface-to-surface missiles (SSMs) or aircraft with spray tanks.
2. Clear drop zones behind enemy lines can be prepared by using non-persistent agents. Airborne troops could enter the area without protective equipment while the attacked troops are fighting in heavy gear and handling large casualties. SCUD SSMs or aircraft with spray tanks would deliver the agent.

3. Use on the flanks of a concentrated attack by covering small concentrations of forces with chemicals prior to commencing mop-up operations. Again, reference is made to using the agents on smaller less able forces to conserve the heavy conventional artillery.

4. Employ persistent highly toxic agents such as mustard and soman so selected areas would be denied access by the enemy. This tactic would confine the enemy, channel his movement, reduce his mobility, complicate his logistics, and concentrate his troops. Alleviating the need for reconnaissance is also attained by area denial. If this tactic were successfully employed behind attacking troops, logistical support could be considerably slower.

5. Air superiority in the final phase of general war is paramount. Use of persistent highly toxic munitions at air defenses and C³ installations would enable their effectiveness for weeks after attack. Conventional bombs designed to crater runways, destroy aircraft servicing facilities and parked aircraft and the use of SSMs or aircraft able to release high concentrations of chemicals throughout the area, could rapidly achieve air superiority. Immediate targeting of logistical elements would follow.⁶⁶

The following assumptions were made for the analysis of battlefield use of chemical weapons by the Iraqis:

1. The Iraqi military is highly likely to be guided by Soviet strategy and to employ Soviet tactics.
2. Iraq has a similar percentage of chemicals mixed in their munitions as the Soviet's do: 30% to 50% of the Soviet conventional weapons stockpile has chemical agents.⁶⁷
3. Iraq has at least 6,000 tons of mustard agent and 10,000 tons of nerve agent⁶⁸

staged for tactical employment. (They could have over five times this much agent).

4. The United States has approximately 30,000 tons of chemicals in storage. Most of it is unusable and dangerous to transport.⁶⁹

5. Fourteen tons of tabun nerve agent are required to contaminate 1 km²; two tons of tabun per 1 km² are required to create an "airborne hazard".

6. Sarin employment requires one-half the amount of tabun.⁷⁰

7. Soman requires one-fourth the amount of tabun.

8. Ten tons of mustard will kill 50% of troops if sprayed over 1 Km².⁷¹

9. VX requires one-fiftieth the amount of tabun.

10. Iraqi troops are well-trained in chemical warfare: defensively and offensively.

11. Iraq has 30 motorized rifle division equivalents; half are equipped with the BM-21.

12. Iraq will stay on the defensive, and under ideal conditions be able to continuously launch 20% of their BM-21 capability every ten minutes.

Figure 1 depicts a hypothetical force-on-force alignment between Iraqi forces to the north of the Saudi-Kuwaiti-Iraq border, and the Allied forces (with American troops) to the south. This analysis assumes Iraq has preserved sufficient chemical munitions, deployed them decisively and has no line of retreat available. To put this hypothetical situation in perspective, remember that the Iraqi policy is to hold onto their 19th province (Kuwait) and her strategy is to protract the ground campaign in a war of human attrition that will sway both Arab and American public opinion against further involvement in the war.

Saddam Hussein's operational concept - as we have shown - will typify Soviet doctrine by trading space for time while causing the maximum amount of casualties with integrated chemical and conventional combined arms armies. As illustrated in Figure 2, Iraqi corps

FIGURE 1

ALLIED vs IRAQI FORCES
(Hypothetical Initial Force Alignment)

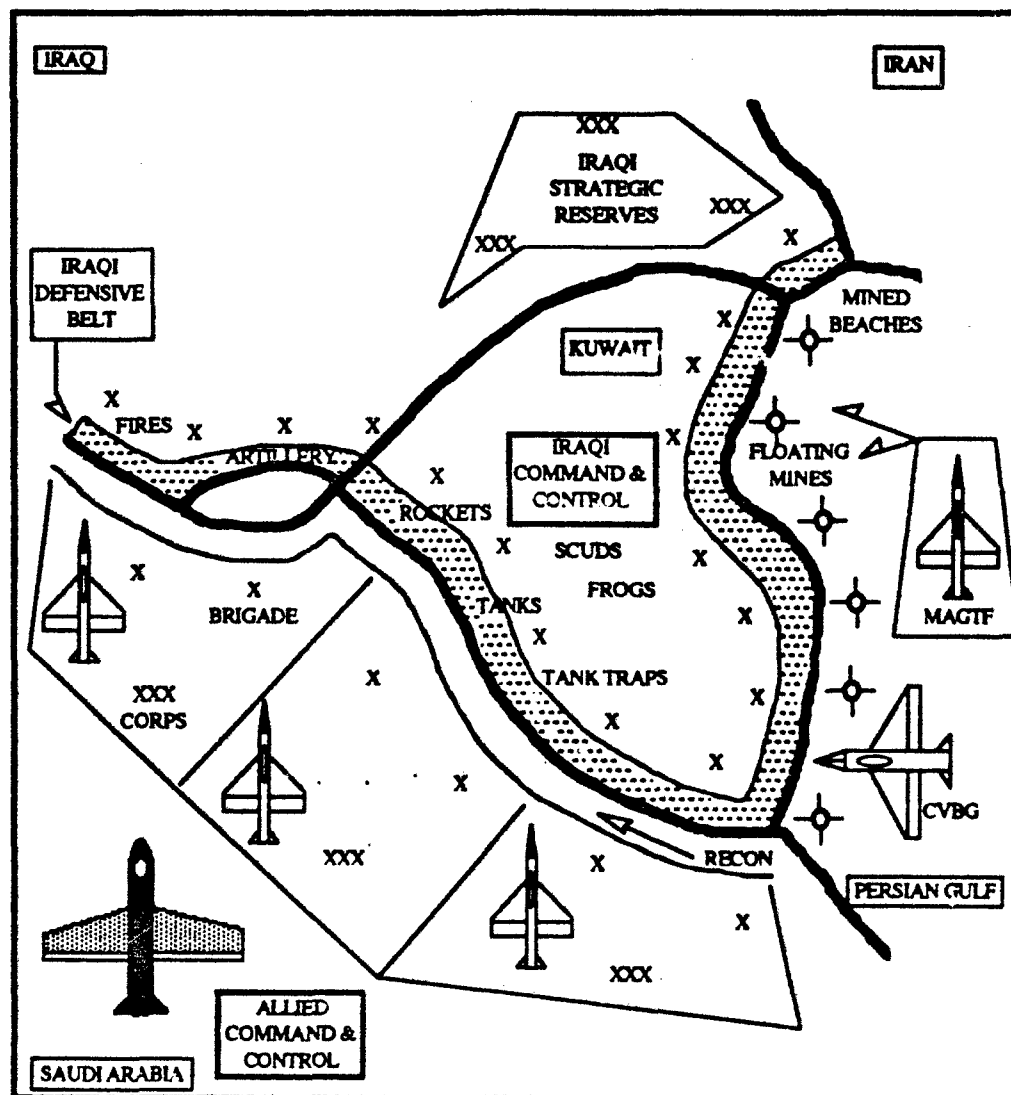
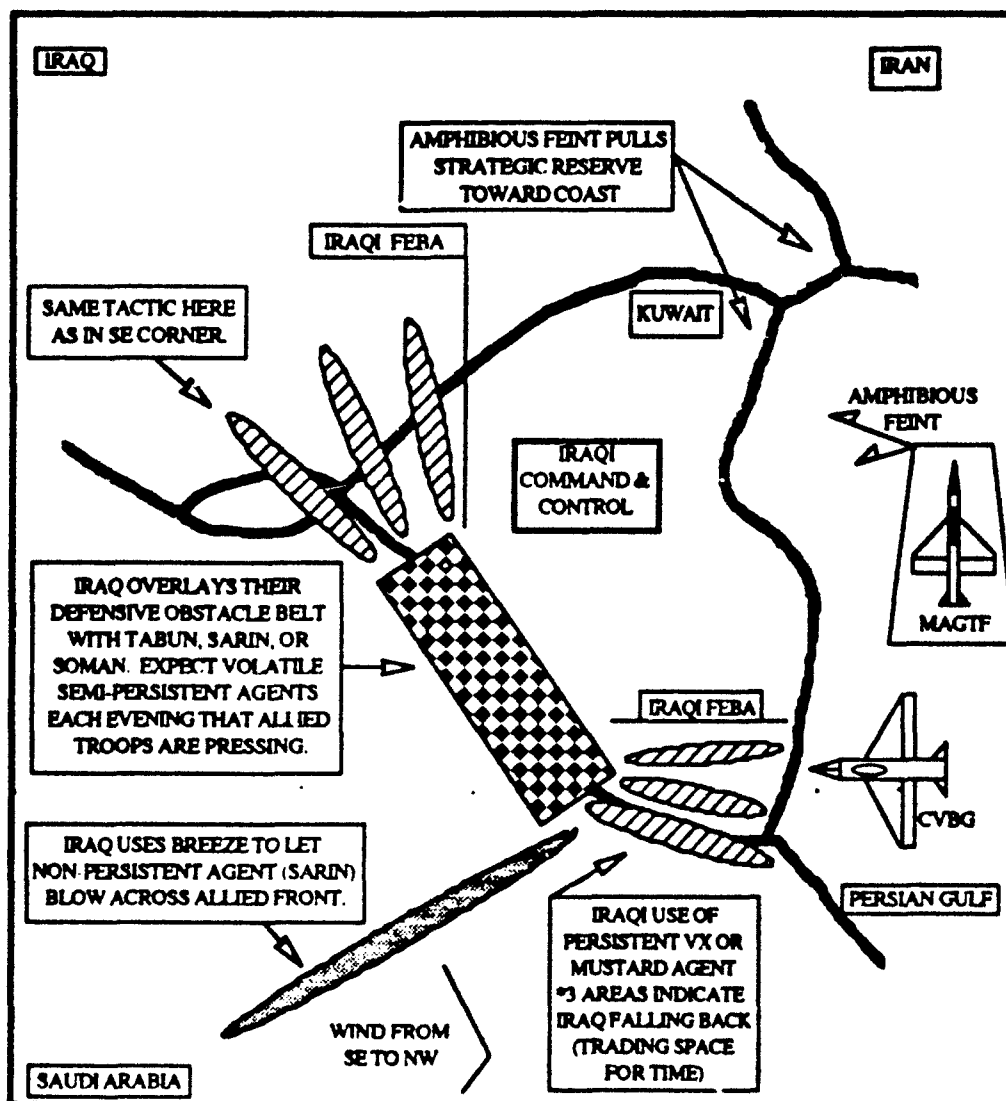


FIGURE 2

ALLIED vs IRAQI FORCES
(Hypothetical D+ [X] Iraqi CW Plan)



commander tactics will demand the use of persistent chemicals for area denial and channelization of Allied troops into predetermined sectors or "killing zones" that will maximize the effectiveness of Iraqi artillery and armor. Additionally, the use of semi-volatile agents directly on troop concentrations at the defensive belt would significantly slow Allied offensives in the area. Finally, the use of non-persistent or volatile agents where the wind would ensure maximum dispersion over rear echelon areas, would slow Allied resupply efforts.

In response to an American amphibious landing, Iraqi use of chemicals during the initial assault could prove highly effective. Working in consort with floating mines, a mined beach head and mobile rocket launchers, the Iraqis could jeopardize Marine chances for success.

Fortunately, the Allies possess air supremacy and U.S. counter-battery fire combined with continuous carpet bombing, Marine close air support, and air interdiction. The land and sea based air echelons will be keeping Iraqi launchers and artillery hidden or vulnerable. Further, Iraqi ability to command and control their forces will be severely degraded while simultaneously falling back against a massive assault in a chemical warfare environment.

CHAPTER VII

SURVEY

In order to get a feel for American capability to operate in a chemical warfare environment such as we may experience during Operation Desert Storm, the authors developed and conducted a survey. This survey was taken from the 404 U.S. students currently attending the College of Naval Warfare and the College of Naval Command and Staff at the U.S. Naval War College. Recognizing that capability depends largely on training, the survey was designed to determine the amount and frequency of chemical warfare training (CWT) received. (See Appendix I).

Of the 404 surveys sent to the students, the authors received 285 responses; of these, 268 were tabulated. (Coast Guard responses were too few to draw any meaningful results from and civilian responses were disregarded because the study's focus was on military capability only). The surveys evaluated were responses from military officers in the grades O-4 to O-6 serving in the U.S. Army, Navy, Marine Corps and Air Force, representing over 4,200 years total active duty service time. (See Table II).

Because the survey was taken from a narrow sample population which is part of a much larger and diverse population, the survey cannot be considered scientific or conclusive. However, the survey does represent an important segment of the tactical and operational leadership of each service. As a result, the data and individual comments obtained from the study are felt to be useful for identifying trends and making general observations about CWT and U.S. capabilities.

TABLE II

**ACTIVE DUTY SERVICE TIME OF SURVEY PARTICIPANTS
(years)**

	<u>NUMBER RESPONSES</u>	<u>TOTAL ACTIVE DUTY TIME</u>	<u>AVERAGE</u>
ARMY	48	866	18.0
NAVY	145	2178	15.0
USMC	40	678	17.0
<u>USAF</u>	<u>35</u>	<u>542</u>	<u>15.5</u>
TOTAL	268	4264	16.0

Almost without exception, the results of the survey demonstrated that the Army and Marine Corps are getting more and better training than the Navy and Air Force. Probably the most telling evidence comes from Figure 3, which shows the average number of hours the officers in the study received during their careers. The disparity becomes acute when noting that both Army and Marine Corps officers get significantly more CWT than their counterparts do combined.

Table III further illustrates the apparent edge our "ground pounders" have over their sister services. Note that 100% of the Army and Marine Corps officers have received some training during their careers while 24.8% of the Naval officers and 11.4% of the Air Force officers responding to the survey received no training at all. Further, Table III shows that the Army and Marines are receiving their CWT more frequently than their counterparts. It is not surprising then that the figures in Table IV reflect a higher degree of confidence the Army and Marine Corps respondents have in their ability to deal with a chemical warfare threat.⁷²

FIGURE 3

AVERAGE NUMBER OF HOURS CWT RECEIVED DURING CAREER

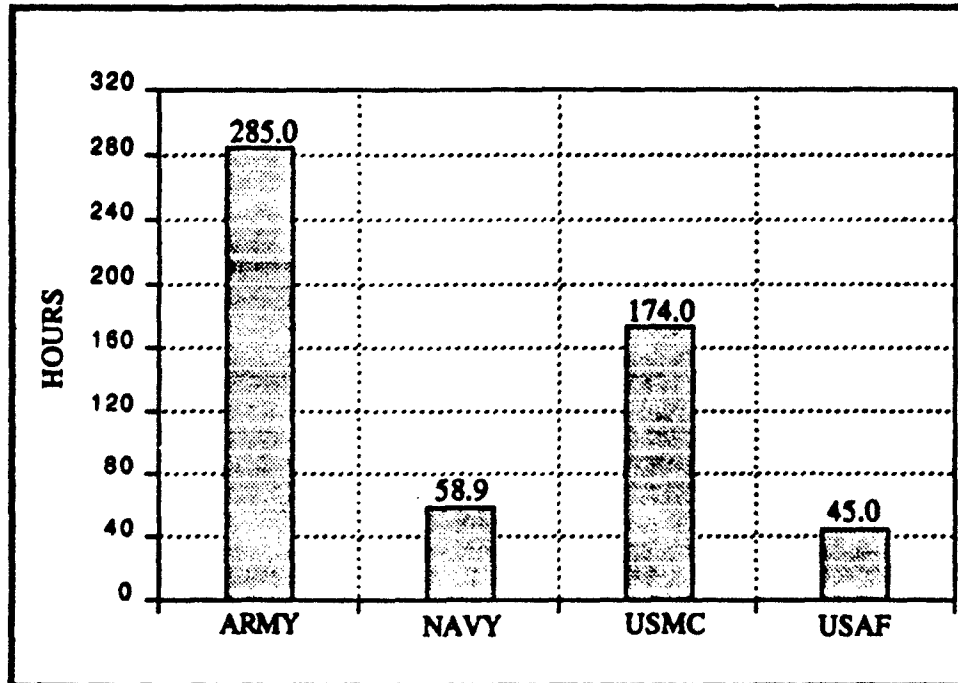


TABLE III

FREQUENCY OF CHEMICAL WARFARE TRAINING
(percent of respondents)

	<u>NONE</u>	<u>NO TRNG LAST 3 YRS</u>	<u>LESS THAN ANNUALLY</u>	<u>SEMI-ANNUAL OR MORE</u>
ARMY	0	10.4	14.6	62.5
NAVY	24.8	33.0	69.7	14.7
USMC	0	30.0	32.5	30.0
USAF	11.4	48.3	29.0	29.0

TABLE IV

CONFIDENCE LEVEL
(percent of respondents)

<u>QUESTION^a</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>AVERAGE</u>
ARMY	64.6	87.5	79.2	62.5	73.5
NAVY	34.9	56.9	40.4	30.3	40.6
USMC	42.5	90.0	55.0	52.5	60.0
USAF	77.4	93.5	64.5	45.2	70.2

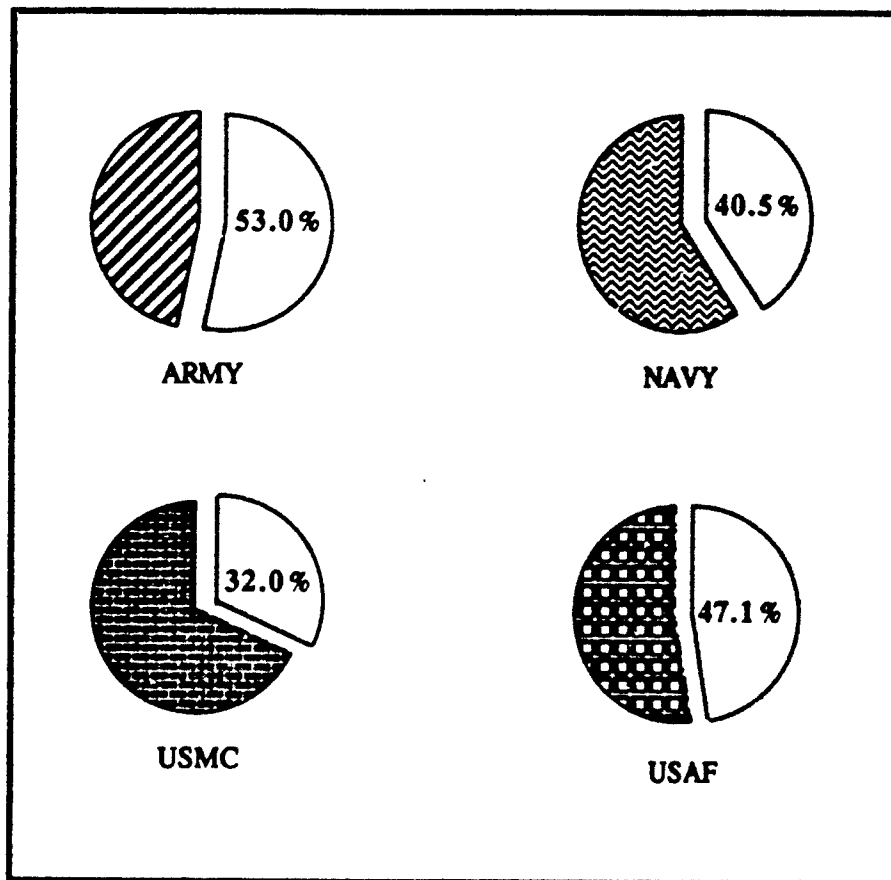
^aThe numbers in the table represent the percentage of yes answers to the following questions:

1. Do you feel your chemical warfare training has been adequate?
2. Do you feel you could survive a chemical warfare attack?
3. Do you feel you effectively do your job in a chemical warfare environment?
4. Are you confident about your ability to function in a chemical warfare environment?

Despite the evident disparity in the amount and frequency of CWT between the Army/Marine Corps and Navy/Air Force, Figure 4 shows the services to be fairly consistent in the amount of CWT conducted in simulated combat environments. This would seem to indicate the relative importance all the services place on realism.

FIGURE 4

AMOUNT OF CWT RECEIVED IN SIMULATED COMBAT



To many, the facts and figures derived from the study may not be that surprising; after all, the Army and Marine Corps are America's front line, down-in-the-trenches war fighters. But interpreting some of the subjective responses to the survey - individual comments - provides insight that supports these results while bringing to light interesting points for consideration.

Probably the most plausible explanation for the survey's results is that the Navy and Air Force do not take the threat of chemical weapons as seriously as the Army and Marine Corps. For example, one of the most common comments given by Naval officers was that chemical warfare at sea is unlikely, and even if chemical weapons were used, the effects would be minimal. Similarly, Air Force officers tended to perceive chemical weapons more of a threat for front line troops than for rear echelon forces such as air bases.⁷³ Aviators especially perceived a minimal chemical warfare threat, probably due to the relative immunity afforded by a pressurized cockpit. These are dangerous attitudes; pilots cannot spend 100% of their time in the protection of a cockpit and must rely on exposed ground and deck personnel to prepare, launch and recover aircraft. Further, because of the many means different types of chemical agents can be delivered - such as Iraq possesses - the threat of chemical attack is just as real and deadly for ships and air bases as it is for the front line "ground pounder." Consequently, CWT should be given as much emphasis in our air and naval forces as in army and marine forces.

The survey also revealed other factors about CWT that deserve some attention. In the Navy, comments varied on the emphasis and quality of training. For example, officers felt that the priority and seriousness of CWT depended on which ship they were assigned to as did the availability and quality of CWT equipment. These observations are likely an accurate assessment of Navy CWT programs because each type command and ship tend to operate

independently, placing different emphasis on training and procurement.²⁴

Even though the Air Force did not fare well comparatively in the study, most of the officers surveyed felt that CWT received ample emphasis in Europe and Korea, citing that chemical warfare training was a "way of life" overseas. While this is comforting, it suggests that CONUS training is not conducted with the same frequency and seriousness. If CONUS-based air forces are expected to deploy rapidly in response to regional crisis - as for Operations Desert Shield and Desert Storm - they should be amply prepared for any threat, including chemical warfare, when they arrive.

There were also several comments that were common across service lines. For example, many officers felt that CWT was not integrated sufficiently into other training - it is one thing to be trained and quite another to be trained while performing your wartime function. Another common observation was that CWT tended to focus more on short-term rather than long-term survival. These comments suggest that while the degree of emphasis in actual CWT may vary between the services, all share some common concerns.

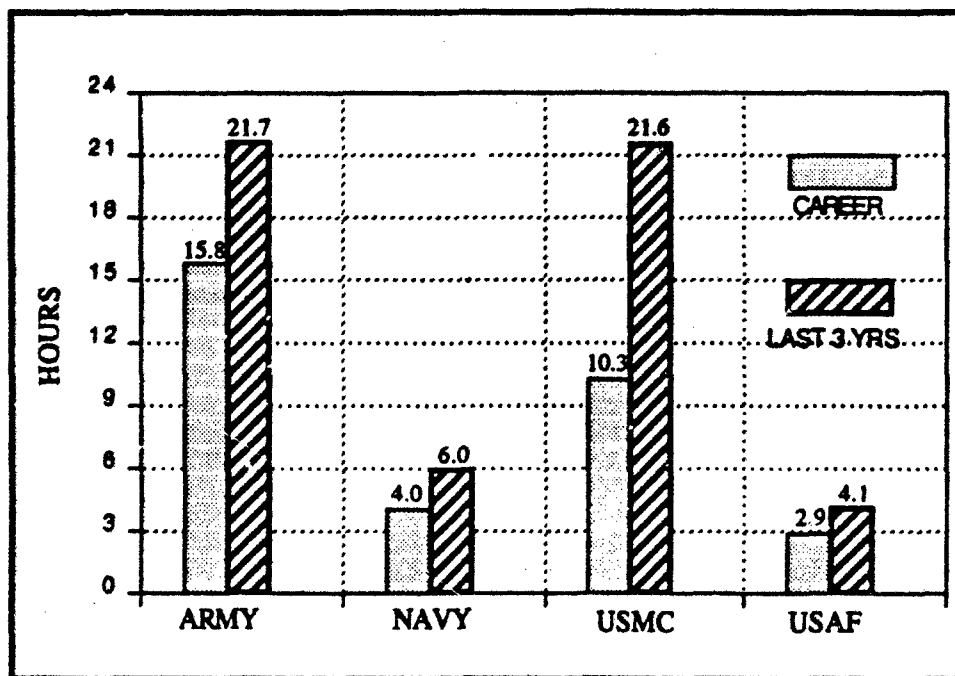
To have any degree of confidence in our military force's capability to be effective in a chemical warfare environment, all services must have a realistic and serious perception of the threat. This would be an important step in insuring a more uniform application of CWT programs. With very few exceptions - submarine and strategic missile crews for example - all members of the military should be trained, regardless of their specialty. Further, not only should the level and amount of CWT be roughly equivalent for each service, it should be fully integrated into other types of training in order to obtain the highest level of individual job performance in a chemical warfare environment.

Recently, there has been increased emphasis on CWT in the military and the results are evident in Figure 5, which shows a rise in annual training during the last three years. Ideally

however, each member of the military should be getting at least eight hours of CWT each year, yet the study shows the Navy and Air Force still far short of this goal.⁷⁵ Perhaps the best way to address CWT in the military would be to establish joint guidelines that address the amount, type, frequency and level of training personnel should receive. There is certainly precedent for this type approach as joint guidelines already exist for safety training in the services.⁷⁶ However the CWT problem is addressed, it is an issue that deserves renewed attention so that all U.S. forces are equally ready and capable to operate effectively in any future conflict that brings with it a potential chemical weapons threat.

FIGURE 5

AVERAGE NUMBER OF HOURS CWT RECEIVED PER YEAR



In light of the study's disturbing implications, the current war in the Persian Gulf raises a serious concern for our military. We have already seen the formidable chemical weapons capability Iraq possesses and have cited examples that demonstrate her willingness to use these weapons. Will such weapons, if used against American forces, seriously affect our ability to fight effectively or will they cause unacceptable casualties? The results of the survey indicate that those forces most vulnerable to chemical attack - Army and Marine Corps - have received the most training and possess a high degree of confidence in their ability to function in a chemical warfare environment. It is likely that while some casualties will be absorbed and advancement will be slowed, U.S. ground forces should still be able to meet their operational objectives. Even though Navy and Air Force forces seem less prepared for chemical attack based upon training, other factors characteristic of this conflict indicate that the chemical threat to sailors and airmen is minimal. For example, since the allies have attained air supremacy, there is little threat of chemical attack by air. In addition, naval and air forces are well beyond the range of Iraq's ability to deliver chemical weapons with artillery. Finally, the demonstrated effectiveness of the Army's Patriot missile defence system coupled with the uncertain accuracy of Iraq's SCUD missile, effectively cancel a long range chemical delivery threat. Consequently, U.S. naval and air forces participating in Operation Desert Storm face a relatively low chemical warfare threat and should be able to carry out their missions effectively.

CHAPTER VIII

CONCLUSIONS

Historical case studies indicate that chemical warfare can be effective tactically, possibly operationally, but rarely strategically. Its use is difficult to verify and it appears to be effective against guerrillas where jungle canopies can be filled with gas and terrain can be denied. Legally, the Geneva Protocol is no more binding upon the U.S.S.R. for compliance than any of the allies. However, no verification system is in place to enforce the agreement and therefore the Protocol remains essentially unenforceable.

When the ground campaign to liberate Kuwait gains sufficient momentum to pressure entrenched Iraqi forces, President Bush and Secretary of Defense Cheney will most probably have to decide how the United States will treat Iraqi use of lethal chemicals on the battlefield. Four NCA choices are:⁷⁷

- A. Use lethal agents in retaliation.
- B. Retaliate with theatre nuclear weapons.
- C. Strategically bomb Iraq population centers.
- D. Prosecute the war as planned without use of nonconventional weapons.

Given limited U.S. capability in the offensive use of chemical munitions, and the adverse political fallout that would accompany the use of theatre nuclear weapons or indiscriminate bombing, we are convinced that the NCA will prosecute the Gulf War as planned utilizing conventional weapons only.

The biggest concern for the United States if chemical weapons are used by Iraq will be the effect it will have on our operational capability. Allied air superiority over Iraq and Kuwait may have significantly degraded Saddam Hussein's command and control capability to

strategically employ a coordinated chemical-conventional war. Assuming that the Iraqi military had the requisite training, adequate mix of VX-HE artillery, and sufficient quantity to practice territorial denial, troop channelling, and fire concentration, their capability now is much less. Unless the Iraqi air force can negate Allied close air support and logistics interdiction, of Iraq's ability to strategically impact the Gulf War with chemical weapons is negligible.

These facts, coupled with the results of the survey that indicate a reasonably high degree of proficiency of our ground forces, lead us to conclude that Iraq's use of chemical weapons may slow American ground forces. However, we feel the results of any chemical attack will not be tactically or operationally significant to unduly jeopardize U.S. military personnel or objectives.

Until the threat of lethal chemical use is totally banned and verified, the U.S. armed services need to have a credible retaliatory capability. Although, current U.S. Army operational doctrine supports offensive chemical warfare to ensure sufficient capability to retaliate, many improvements will have to be made, including increased chemical agent production and delivery platforms in order to meet the growing third-world threat. Given a rejuvenated offensive capability, the United States will finally have the operational capability to match her stated policy of deterrence through retaliation.

APPENDIX I

CHEMICAL WARFARE QUESTIONNAIRE

1. SERVICE INFORMATION

USAF _____ ARMY _____ NAVY _____ USMC _____ USCG _____ CIV _____

Rank/Grade _____

Are you in the Reserves or National Guard? YES _____ NO _____

Total active duty service time _____

Service specialty

(Examples)

- _____ Aviation front line (flyer/aircrew member)
- _____ Aviation support (logistics/acft maintenance/AMMO, etc.)
- _____ Ground front line (infantry/tanks/artillery, etc.)
- _____ Ground support (intel/comm/supply/SHABEES, etc.)
- _____ Surface front line (nonflying carrier personnel/combatants, etc.)
- _____ Surface support (troop transport/supply ship/hospital, etc.)
- _____ Subsurface
- _____ Other (please specify) _____

2. Have you ever received formal military training in any area of chemical warfare? Yes _____ No _____

(If "No", then you are done; please return the questionnaire)

3. TYPE AND EXTENT OF CHEM WARFARE TRAINING RECEIVED

I have received the following chemical warfare training during my career: (check those that apply)

- _____ Physiological effects of chemical weapons
- _____ First aid (BUDDY CARE, use of atropine, personal decon, etc.)
- _____ Tactical considerations (effects on operations, equipment decon, etc.)
- _____ Use of chemical warfare ensemble (mask, hood, gloves, suit, booties, etc.)
- _____ Protection of weapons, equipment
- _____ Testing for the presence of chemical agents/recognition
- _____ Warning signals/alert stages

How often have you been trained on average?

- _____ Less than annually
- _____ At least once a year
- _____ Semi-annually
- _____ More than semi-annually

Number of hours of chemical warfare training in the last three years _____

Number of hours of chemical warfare training during your career _____

(OVER PLEASE)

Have you received any of this training in a simulated combat environment?

☐ Yes ☐ No

If so, how often?

☐ Less than annually
☐ At least once a year
☐ Semi-annually
☐ More than semi-annually

Number of hours of CV training in simulated combat in the last three years _____

Number of hours of CV training in simulated combat during your career _____

Have you ever trained in the OFFENSIVE use of chemical weapons?

☐ Yes ☐ No

If so, approximate percentage of time spent on offensive training _____%

4. WARN FUZZY FACTORS

Do you feel your chemical warfare training has been adequate? ☐ Yes ☐ No

Do you feel you could survive a chemical warfare attack? ☐ Yes ☐ No

Do you feel you could effectively do your job in a CV environment?

☐ Yes ☐ No

Are you confident about your ability to function in a CV environment?

☐ Yes ☐ No

5. OTHER COMMENTS

THANK YOU FOR YOUR SUPPORT!

(please return this questionnaire to one of the boxes in Hewitt Hall, deck 2 or
3. You can also drop it off at cubicle 3169, or 3169A, deck 3.)

NOTES

1. 19:10-13.
2. 8:14.
3. 19:10-11.
4. 8:13.
5. 8:31.
6. 8:32.
7. 10:51.
8. 8:53, 8:55.
9. 8:62-63.
10. 8:62, 8:88.
11. 8:90-91.
12. 8:91.
13. 8:97.
14. 5:13.
15. 8:107.
16. 1:1.

17. 10:53.
18. 2:57.
19. 10:54.
20. 10:57.
21. 19:10-11.
22. 19:10-12.
23. 19:10-13.
24. Ibid.
25. 19:10-14.
26. 19:10-13.
27. 19:10-14.
28. Ibid.
29. 19:10-15, 19:18.
30. 5:26.
31. Ibid.
32. 9:2.
33. 5:26.
34. 16:1.

35. 5:17.

36. 6:C13.

37. 17:9, 17:15.

38. 10:52.

39. 5:18.

40. 5:17.

41. 10:53.

42. 1:2.

43. 4:111.

44. 5:36.

45. 8:1.

46. 8:4.

47. 8:4-5.

48. 8:5.

49. Ibid.

50. 8:6.

51. 7:86.

52. 8:211.

53. 8:6.

54. 8:7.

55. Ibid.

56. Ibid.

57. Ibid.

58. 8:8.

59. Ibid.

60. Ibid.

61. 8:9.

62. Ibid.

63. 8:9-10.

64. 8:10.

65. 8:1-2.

66. 5:19, 5:21.

67. 5:22.

68. 1:7.

69. 11:26.

70. 1:21.

71. 11:26.

72. While USAF confidence figures in Table IV do not appear to fit the pattern supported by the survey, it is important to note that 80% of the Air Force officers responding were pilots. It is natural to assume that an aviator's confidence to perform effectively in a chemical warfare environment would be higher while performing the majority of his wartime tasks in the enclosed environment of an aircraft.

73. Once again, given the high proportion of pilots responding to the survey, this attitude should not be interpreted as universal among Air Force officers. It is the authors' opinion that non-flying officers, especially direct aviation support types, have a greater appreciation of the chemical warfare threat. However, it should be pointed out that the overwhelming majority of Air Force leadership, especially at the policy making level, are pilots.

74. Taken from an interview with Major Mike Spencer, U.S. Army, NBC Affairs, U.S. Army Element, Naval Activities, Office of the Deputy Chief of Staff for Operations, Headquarters, Department of the Army, Surface Warfare Officer Schools Command, Newport RI: 4 February, 1991.

75. Ibid.

76. Here the authors are referring to the Armed Services Occupational Safety and Health standards employed by each service.

77. 9:2.

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